

8/05/04
TD-04-035

SR01 Test Summary Report

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1. Introduction

SR01 arrived at IB1 on January 29th, 2004 and on February 3th it was attached to VMTF top plate. Electrical checkout was complete on February 9th. SR01 was cooled down on February 16th and the test started on February 17th.

Due to the low inductance of SR01 the PS supply was oscillating and we had to bus into the system a main injector magnet to perform the test. Using this configuration the test was limited to 20 kA. Once the PS was tuned to operate with zero inductance load we were able to continue testing on March 9th. The magnet test has been completed on March 20.

2. Quench History

The first quench of the magnet occurred at relatively high current of 19292A with a ramp rate of 20A/sec. It took 14 more quenches at 20A/sec ramp rate to train the magnet. The maximum current value was at 23713A. This value is consistent with the calculated critical current value estimated by measuring critical current of strands at the Short Sample Test Facility (SSTF).

After the magnet has been trained we performed ramp rate and temperature dependence studies. Both of these studies indicated that the magnet reached its critical current limit. At 2.2K we exposed the magnet to larger Lorentz forces, so if the magnet was not trained at 4.5K we should have accelerated its training at 2.2K. On the other hand if the magnet reached its critical limit value it should not show any sign of quench current improvement once it is warmed up again to 4.5K. From Fig. 1 one can conclude that the magnet quench current remained the same consequently the magnet reached its critical current limit.

The quench history plot is presented in fig 1. and in table 1. Table 1 also shows the quench locations and the quench starting time. The voltage taps positions on the coil are illustrated in fig. 2. In fig. 3-4-5-6 typical quench signals are plotted.

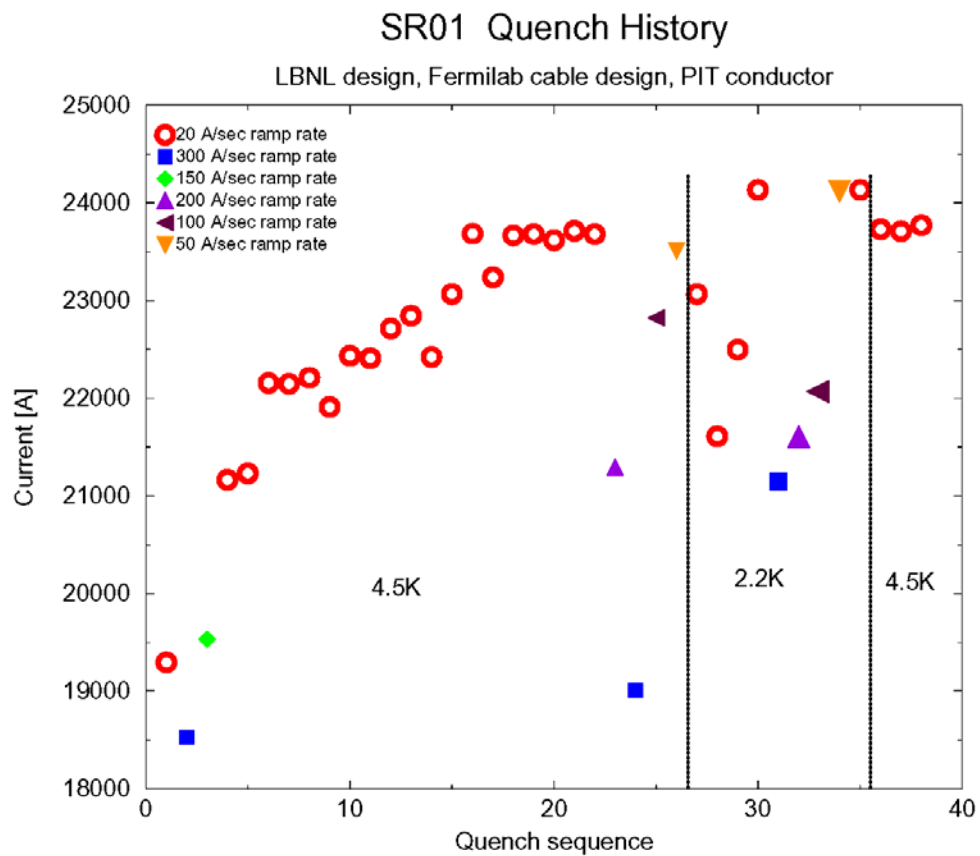
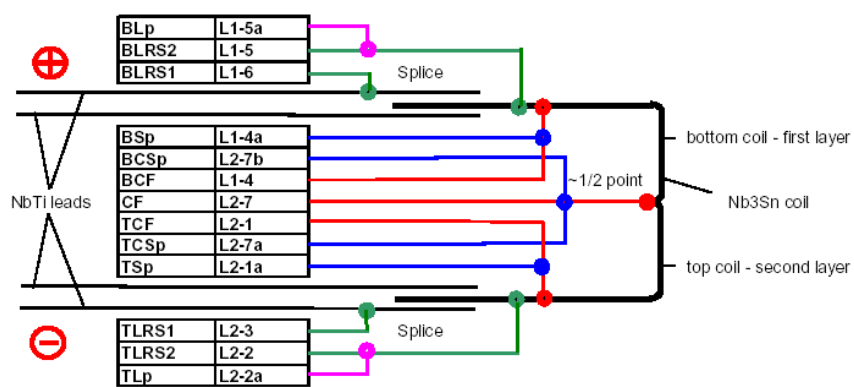


Figure
history



1.
Quench

Figure 2. Voltage Tap position

Quench #	Quench File	Current, A	Ramp Rate, A/s	Temp, K	t_{quench}	MITs	Quench Start Tap Segment
1	sr01.Quench.040217201511.135	19292	20	4.5	-0.0024	4.48	QTLRS2_QBLRS2
2	sr01.Quench.040217210001.267	18526	300	4.5	-0.0018	4.10	TapHalfcoilH2
3	sr01.Quench.040217211815.236	19530	150	4.5	-0.0026	4.58	QTLRS2_QBLRS2
4	sr01.Quench.040309104043.742	21145	20	4.5	-0.0042	22.79	TapHalfcoilH1
5	sr01.Quench.040309111709.510	21229	20	4.5	-0.0042	16.39	TapHalfcoilH1
6	sr01.Quench.040309114921.124	22155	20	4.5	-0.0031	16.92	TapHalfcoilH1
7	sr01.Quench.040309150615.595	22150	20	4.5	-0.0033	18.09	TapHalfcoilH1
8	sr01.Quench.040309153227.686	22210	20	4.5	-0.0036	23.23	TapHalfcoilH1
9	sr01.Quench.040309160009.509	21910	20	4.5	-0.0043	26.51	TapHalfcoilH1
10	sr01.Quench.040309162801.917	22435	20	4.5	-0.0032	16.47	TapHalfcoilH2
11	sr01.Quench.040309165450.974	22410	20	4.5	-0.0033	16.66	TapHalfcoilH1
12	sr01.Quench.040309172300.989	22715	20	4.5	-0.0032	16.67	TapHalfcoilH1
13	sr01.Quench.040309174701.859	22842	20	4.5	-0.0031	16.71	TapHalfcoilH1
14	sr01.Quench.040309181526.923	22422	20	4.5	-0.0031	16.66	TapHalfcoilH1
15	sr01.Quench.040309184531.891	23067	20	4.5	-0.0033	6.56	QTLRS2_QBLRS2
16	sr01.Quench.040309195751.089	23686	20	4.5	-0.0036	2.69	QTLRS2_QBLRS2
17	sr01.Quench.040309203029.466	23242	20	4.5	-0.0035	2.59	TapHalfcoilH1
18	sr01.Quench.040310090213.711	23667	20	4.5	-0.0035	22.11	TapHalfcoilH1
19	sr01.Quench.040310094153.865	23682	20	4.5	-0.0035	23.96	TapHalfcoilH1
20	sr01.Quench.040310101623.742	23618	20	4.5	-0.0034	21.61	TapHalfcoilH1
21	sr01.Quench.040310104710.530	23679	20	4.5	-0.0034	8.73	TapHalfcoilH1
22	sr01.Quench.040310112649.217	23713	20	4.5	-0.0031	15.96	TapHalfcoilH1
23	sr01.Quench.040310115514.858	23680	20	4.5	-0.0036	10.98	TapHalfcoilH1
24	sr01.Quench.040310120628.648	21295	200	4.5	-0.0032	15.80	TapHalfcoilH1
25	sr01.Quench.040310121635.417	19008	300	4.5	-0.0040	0.40	TapHalfcoilH2
26	sr01.Quench.040310122958.740	22824	100	4.5	-0.0031	1.72	TapHalfcoilH1
27	sr01.Quench.040310124736.520	23516	50	4.5	-0.0032	2.27	TapHalfcoilH1
28	sr01.Quench.040310162410.265	23067	20	2.15	-0.0042	17.86	TapHalfcoilH1
29	sr01.Quench.040311102424.239	21609	20	2.2	-0.0044	23.21	TapHalfcoilH1
30	sr01.Quench.040311155134.250	22497	20	2.2	-0.0053	5.70	QTLRS2_QBLRS2
31	sr01.Quench.040311164437.528	24136	20	2.2	-0.0032	1.81	QTLRS2_QBLRS2
32	sr01.Quench.040311165421.673	21148	300	2.2	-0.0042	6.43	TapHalfcoilH1
33	sr01.Quench.040311170416.177	21595	200	2.2	-0.0047	2.75	QTLRS2_QBLRS2
34	sr01.Quench.040311171537.822	22069	100	2.2	-0.0047	4.48	QTLRS2_QBLRS2
35	sr01.Quench.040311172811.816	24133	50	2.2	-0.0032	1.70	QTLRS2_QBLRS2
36	sr01.Quench.040311175335.290	24135	20	2.2	-0.0038	7.99	QTLRS2_QBLRS2
37	sr01.Quench.040315105251.187	23733	20	4.42	-0.0035	1.71	QTLRS2_QBLRS2
38	sr01.Quench.040315111951.240	23712	20	4.42	-0.0039	2.99	QTLRS2_QBLRS2
39	sr01.Quench.040315113030.760	23771	20	4.42	-0.0033	2.68	QTLRS2_QBLRS2

Table 1. Quench history.

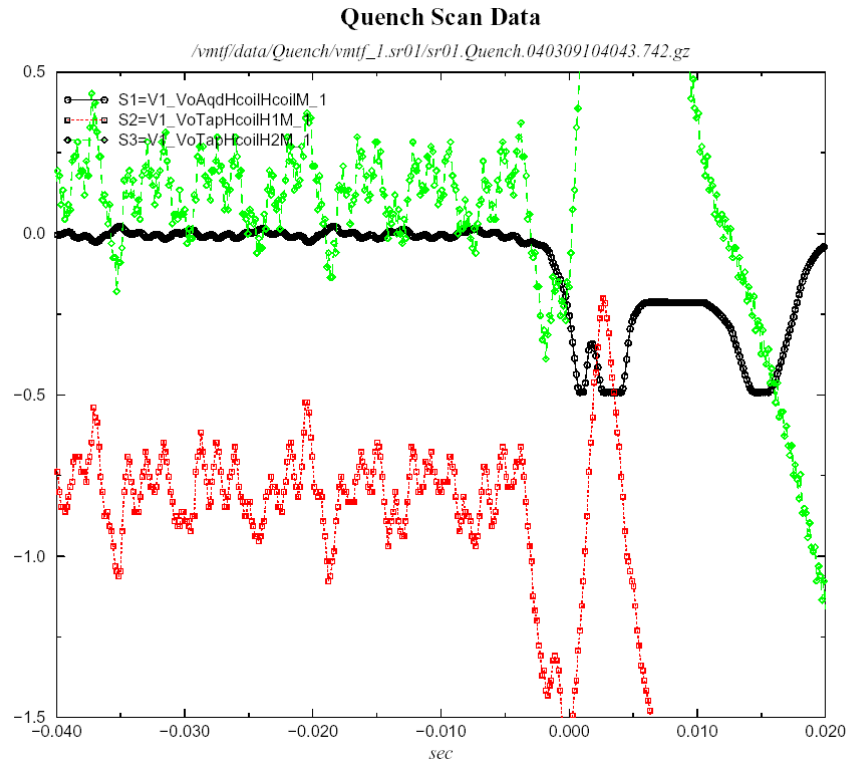


Fig.3 Quench #4 signals from coil taps

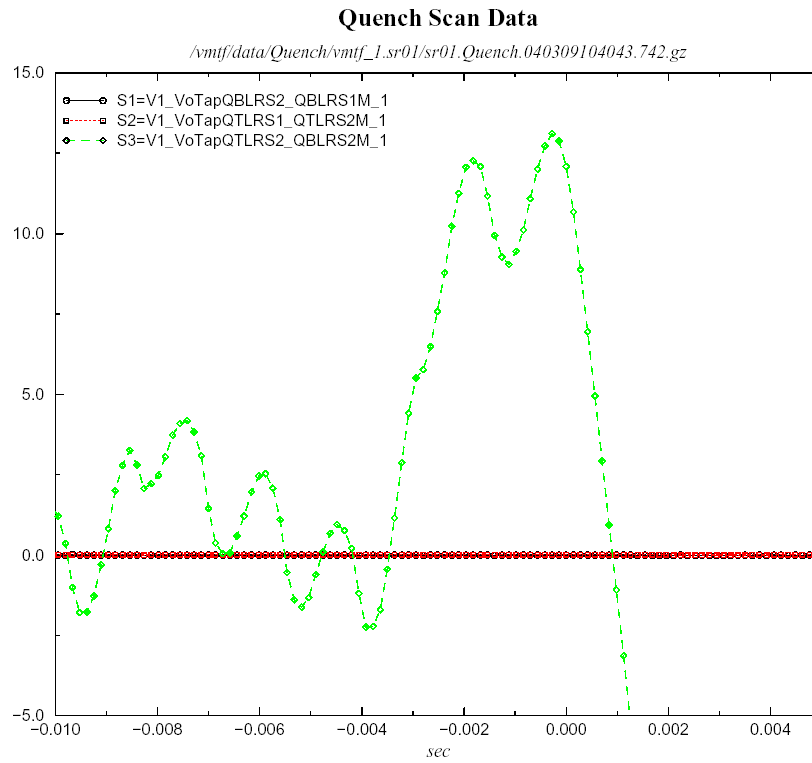


Fig.4 Quench #4 signals from splice taps

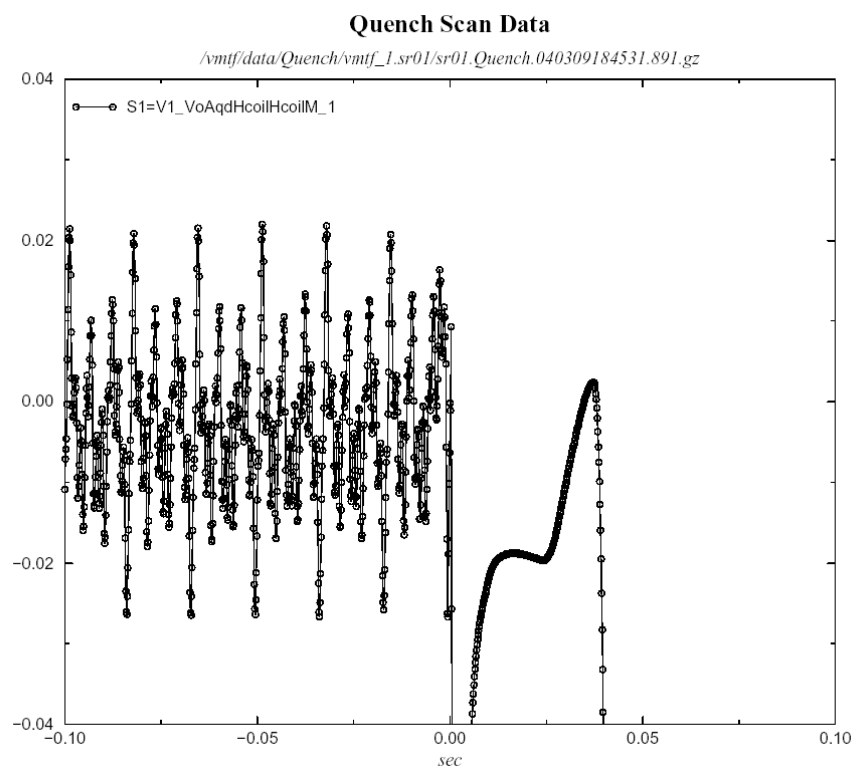


Fig.5 Quench #15 signals from coil taps

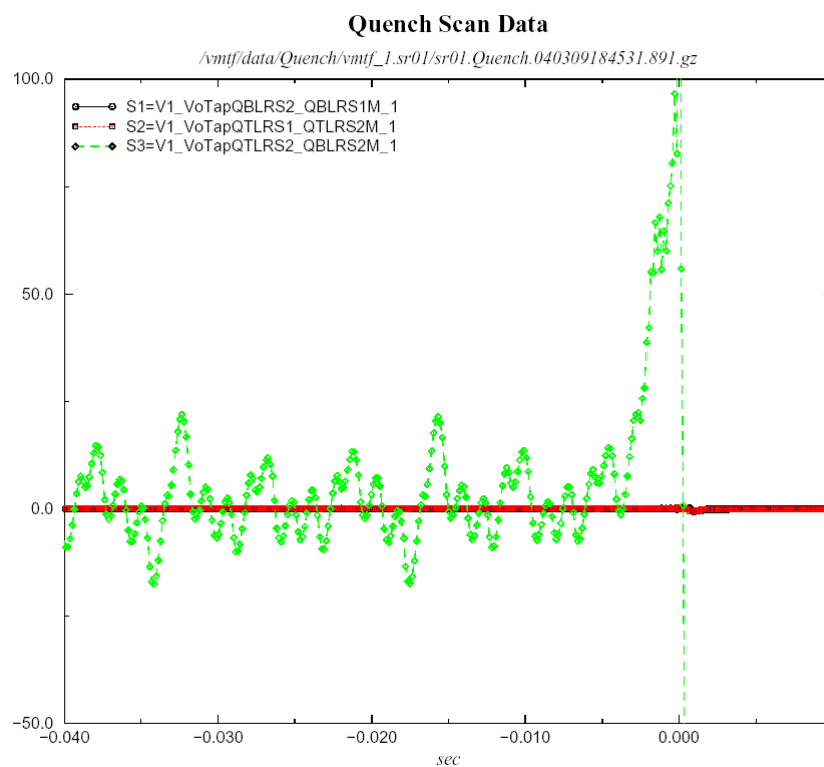


Fig.6 Quench #15 signals from splice taps

3. Ramp Rate Dependence

The default current ramp rate was 20 A/sec. We performed a ramp rate dependence study at 4.5K (red spot) and at 2.2K (blue spot) which is summarized in Figure 7. The smooth decrease of the quench current increasing the ramp rate at 4.5K confirms that the cables reached the critical current limit.

At 2.2 K the erratic dependence with the ramp rate is probably related to cable instabilities.

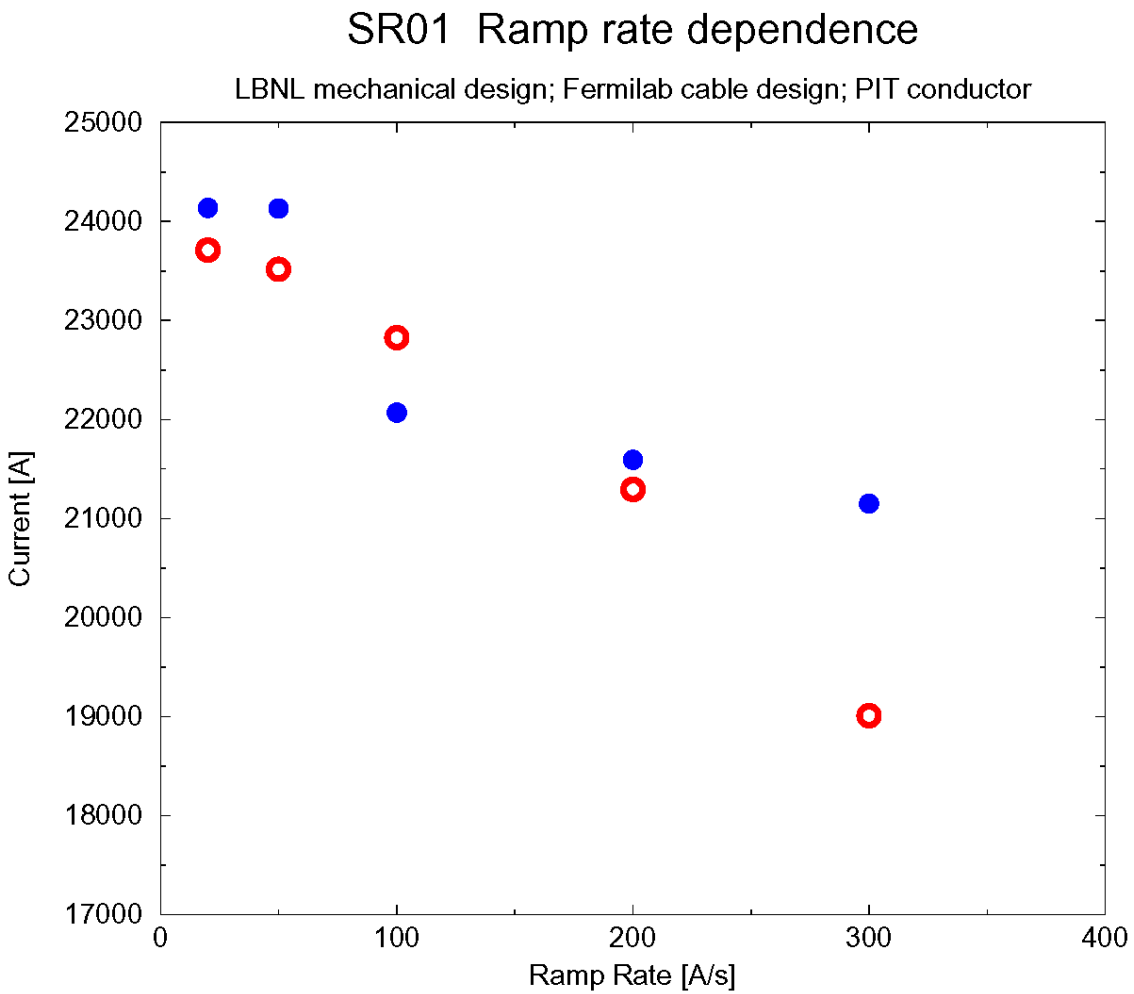


Figure 7. Current ramp rate dependence.

4. Splice measurement

We performed splice measurements. The voltage drops across the splices were recorded while the current was ramped up to 20000 A and down to 0. Figure 3 shows the results of the measurements.

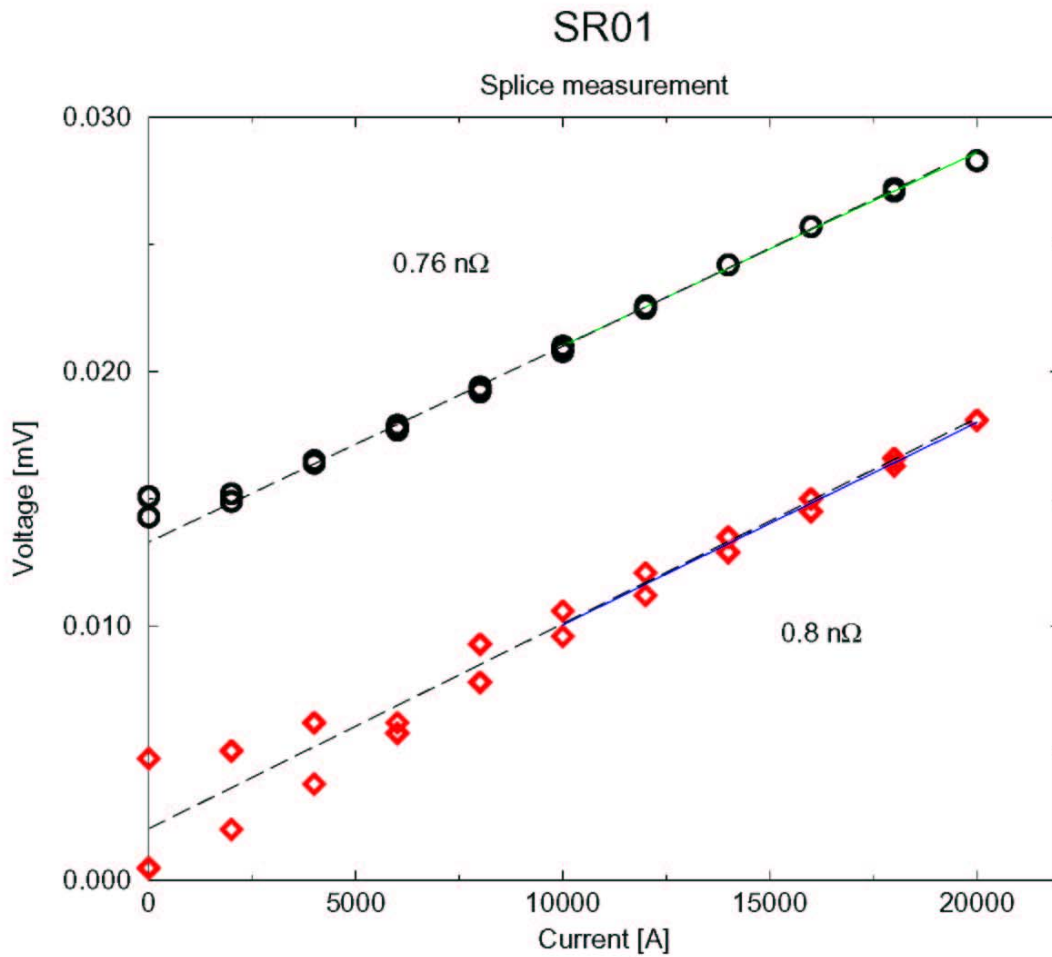


Figure 8. Splice measurements.

6. RRR measurement

The RRR measurement was performed between 03/17/2004 and 03/22/2004. We used 10 A current to perform 4 wire resistance measurements while the magnet was gradually warming up. The measured RRR value is 129.